

**ABSTRACT:**

A waste liquid treatment system includes a plurality of flow control elements presenting a plurality of waste liquid flow control surfaces. A biofilm covers at least some of the waste liquid flow control surfaces. The flow control surfaces are adapted and constructed to produce alternating venturis and variable speed vortices as waste liquid flows through the flow control elements. In an embodiment, each of the flow control elements comprises a series of fins and vanes forming the water flow control surfaces.

- 3 Each of the flow control elements can include an inner member having a longitudinal axis, with a plurality of vanes extending radially from the longitudinal axis. A cylindrical outer member can be provided surrounding the inner member, the cylindrical outer member having an outer surface including a plurality of radially projecting longitudinal fins formed thereon. In a specific embodiment, the inner member has eight vanes, and the cylindrical outer member is provided with four fins. The flow control elements can be formed from a plastic material. The biofilm can be provided as a biofilm-expressing bacteria, providing an endemic or seeding biofilm. The nature of the biofilm depends upon the nature of the liquid to be treated and the specific contaminants to be removed. Examples of suitable biofilms include pseudomonous species based biofilm and biofilms including sulfur-reducing bacteria species. A method of treating waste liquid includes the step of providing a plurality of flow control elements presenting a plurality of waste liquid flow control surfaces. Next, at least some of the waste liquid flow control surfaces are covered with a biofilm. The waste liquid is then caused to flow through the flow control elements to produce alternating venturis and variable speed vortices as waste liquid flows through the flow control elements.